Experiences in the Assessment of the Requirement Management Process

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Abstract

The focus of this paper is to outline the practical experiences and the lessons learned derived from the assessment of the requirements management process in two industrial case studies. Furthermore this paper explains the main structure of an alternative assessment approach that has been used in the appraisal of the two case studies. The assessment approach helped us to know the current state of the organizational requirement management process. We have to point out that these practical experiences and the lessons learned can be helpful to reduce risks and costs of the on-site assessment process.

Keywords

Capability maturity model, CMMI, requirement management, SCAMPI, software process assessment, software process improvement

1 Introduction

The main objective of this paper is to present the practical experiences and the lessons learned derived from the assessment of the requirements management process in two industrial case studies using the Capability Maturity Model Integration (CMMI) [1, 2] as a reference model. However, in order to understand the problem, the objectives, and the alternative assessment approach structure, this paper is divided into five main sections.

Section 1 presents a quick view of ISPI's software process improvement model [3], and a quick view of the requirements management process. Section 2 presents the problematic of in the use of SCAMPI [4] and describes the structure of an alternative assessment approach. Section 3 present the data analysis of the two industrial case studies. Section 4 present the practical experiences and the lessons learned derived from the assessment of the requirement management process. Section 5 presents the paper conclusions.

1.1 Software Process Improvement Models

During the last few years, several Software Process Improvement (SPI) models have been developed to increase the quality and productivity of software. Models like IDEAL [5] or ISO/IEC TR 15504-7 [6] have been useful to initiate a software process improvement effort in many organizations. However, such models are expensive and time consuming, and hence small organizations find some difficulties to perform them.

To solve the inconveniencies associated with the high cost and time consuming the Institute for Software Process Improvement (ISPI) developed a new simplified SPI model. It takes the advantages of IDEAL and ISO but reduces the number of stages at only four [3].

Stage 1: *Commitment to Improvement*, its objective is to obtain senior management commitment to carry out the improvement project. Stage 2: *Software process assessment*, its objective is to obtain strengths and weaknesses of the process with respect to a software process model. Stage 3: *Infrastructure and action a plan*, it has two objectives, the first is to provide the necessary infrastructure for the improvement project, and the second is to design the improvement action plans. Stage 4: *SPI Implementation*, its objective is to implement and institutionalize the software process improvements.

A group of professors from three Spanish universities: Polytechnic of Madrid (UPM), Carlos III (UC3M) and Open University (UNED) has been using ISPI's model since 1994 with good results [7]. The main objective of the group is promoting SPI initiatives among Spanish organizations. Consequently, the professor's group is still using the ISPI's model and has enhanced it with their projects experiences.

1.2 Requirements Management Process

The requirements are the foundation, upon which the software process is built, and the Requirements Management (RM) process emerges as a systematic approach to find, document, organize, and track all system's requirements during the life cycle. But unclear requirements and the inability to manage requirements change are the cause of the most part of delays on the software development process [8].

According to a SEI's Study [9], the top two out of ten factors that contribute to the failure of system development projects are requirements problems. These problems are mainly associated with an inadequate requirements specification and/or an insufficient requirements change management. Also the Standish Group's CHAOS report [10] found that the major factors that cause software projects to fail are: lack of user input, incomplete requirements specifications, and changing requirement specifications.

Therefore, RM process is considered the cornerstone of the software lifecycle and CMMI identifies the enormous importance of the RM, granting the category of "Process Area" and placing it in the CMMI, staged representation, maturity level two [2]. According to the CMMI, the Requirements Management major aim is establishing an agreement between the customer and the software team on the meaning of the requirements [1, 2].

2 Assessment Method

2.1 SCAMPI

The Software Engineering Institute (SEI) establishes that one of the first steps of a SPI project is to understand the current state of the process [5]. Therefore the SEI developed SCAMPI [4] as the assessment method to know the current state of the organizations software process using the CMMI as reference model.

SCAMPI describes the activities to assess the software process, however, it is an expensive method because consumes a lot of resources like: team size, training and cost (time and money). In some organizations the SCAMPI assessment cost could be too high from 40,000 to 100,000 USD [11]. The cost and effort of a SCAMPI assessment might be too big particularly in small organizations.

2.2 Alternative Assessment Approach

To determine the perform level of the requirements management process, we use the ISPI's model and develop an alternative assessment approach. This approach is based on the use of a questionnaire for data collection and the subsequent data analysis. The questionnaire is based on the two types of practices of the requirements management process area (REQM) described in the CMMI [1, 2] and it is divided into two sections: The first one is related to the specific practices and describes the series of steps that have to be followed to perform the process. The second one is related to the generic practices and describes the series of steps that have to be followed to institutionalize the process.

The questionnaire contains closed questions with five possible answers to know the extent to which practice is performed. The answer options and the numeric value to calculate the arithmetic mean are: almost always (1), more often (0.75), sometimes (0.5), rarely if ever (0.25), and never (0) (Figure 1).

between: and:	(PI <= 100) (PI > 75)	(PI <= 75) (PI > 50)	(PI <= 50) (PI > 25)	(PI <= 25) (PI > 0)	PI = 0
Documented	Almost always	More often	Sometimes	Rarely if ever	Never
Not documented	More often	Sometimes	Sometimes	Rarely if ever	Never

Figure 1. Answer option perform level (PI)

For realizing the data analysis, the arithmetic mean (Σ) is calculated with all valid answers for each question (practice or subpractice). Subsequently, those practices which arithmetic mean is smaller than 75% are considered as candidates for improving (weakness), but only, if the standard deviation is smaller or equal to one. On the other hand, those practices which arithmetic mean is greater or equal to 75% could be consider process strengths, but only, if the standard deviation is smaller or equal to one. So, if the standard deviation is greater than one, there are strong discrepancies between the answers. Therefore, it is necessary to analyze the answer-question in more detail with the use of interview techniques. (Figure 2).

	standard deviation <= 1	standard deviation > 1
Σ >= 75%	STRENGTH	INTERVIEWS
Σ < 75%	WEAKNESS	INTERVIEWS

Figure 2. Data analysis table to establish practice perform level

This assessment approach may be helpful to obtain information that reduce risks and costs of the on-site assessment process and to classify practices in those that are performed but not documented, those that require prioritizing and those that are not implemented.

3 *Case Studies*

The assessment approach proposed in this paper was used in the assessment of the requirements management process of two industrial case studies with the purpose of validating it.

We have to point out that firstly is very important to obtain senior management commitment with regard to people, time and other resources needed for the software process improvement project. Senior management commitment must be embedded in all decisions to be made throughout the improvement project, and these decisions must be communicated to all involved people.

3.1 Data Analysis

3.1.1 Specific Practices

The first section of the assessment analysis focuses on determining the current state of the activities of the RM process using as reference the five specific practices of REQM. The analysis of the values obtained from the answers of two case studies found that none of the five Specific Practices (SP) achieves the minimal performance level (75%) to be considered as process strengths. However, there are three practices in the case study 1 and two in the case study 2 between 50% and 75% of performance level. This suggests that the improvement effort must be focus on documenting the process. On the other hand, the values obtained for the remaining practices were under 50%. This suggests that for these practices it is necessary a greater improvement effort (Figure 3).

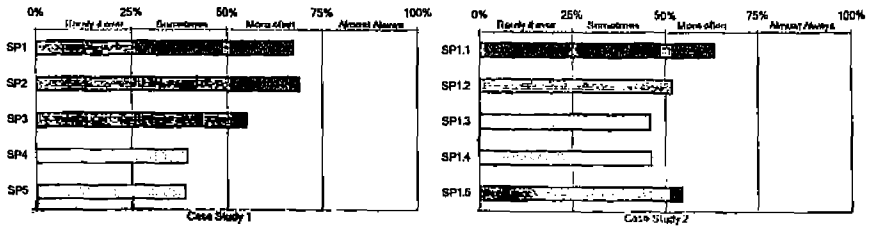

Figure 3. Requirements Management specific practices perform level

3.1.2 Generic Practices

The second section of the assessment analysis focuses on determining those practices related to the process institutionalization. These are labeled Generic Practices (GP) by the CMMI because are used in all process areas. The analysis of the obtained values from the answers of two case studies found that none of the ten GP achieves the minimal performance level (75%) to be considered as an institutionalized process. This observation was expected since none SP was rated equal to 75% of perform level. Nonetheless, there is one practice in case study 1 between 50% and 75% performance level. This suggests that the improvement effort for this practice must be focus on documenting the process. On the other hand, three practices in the case study1 and two in the case study 2 are fewer than 25% of performance. This suggests that these practices are poorly performed and require a great effort to implement them (Figure 4).

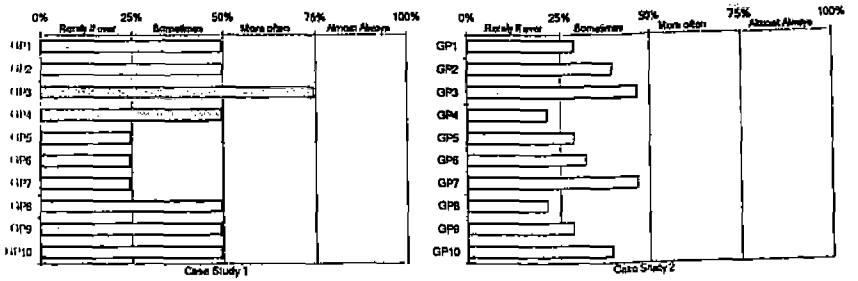

Figure 4. Requirements Management generic practices perform level

4 *Practical experiences and lessons learned*

In this section, the lessons learned from the assessment of the requirements management process in two industrial case studies are presented.

- In the two case studies we discover an initial resistance to change from almost all the affected people. It is important to select people which are interested in the process improvement to decrease the change resistance.
- It is essential to designate a project manager who will be in charge of the improvement project.
- Senior management must give explicitly samples of commitment like attending the most important meetings, inform to all people involved in the project about the results of the assessment, inform to all organization's personal about the improvement policy, etc.
- The assessment has to be collaborative and it is necessary training the members of the organization that are going to participate in the assessment.
- People who answer the questionnaire must have sufficient organizational and process knowledge.
- Each question must be answered after each specific or generic practice is explained.
- Answers to questionnaire will be focus on the way organization works and not on specific projects.
- The application of the questionnaire to all the people involved in the process allows reducing the number of interviews. However, all the ambiguous issues from the questionnaire answers must be prepared in detail for the interview stage.
- As a result of the assessment, a draft of the action plan is included, defining short-term priorities and activities to continue with the process improvement effort.

5 *Conclusions*

This work of investigation proposes an alternative approach to help in the assessment of the requirements management process, using a questionnaire and a simple method that allows obtaining results in a fast form. The results derived from their application of two case studies not only demonstrate the effec-

tiveness of the approach, but also takes the assessment experiences to be considered in other similar projects.

We have to point out that assessment does not in itself provide any improvement but it provides valuable information of the current state of the process and it lays the foundation for making the right choices about the changes you should make.

6 *Literature*

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